

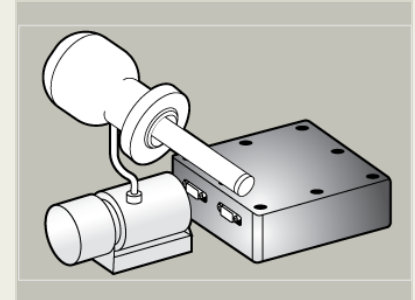
# Deep Space Cryocooler System (DSCS), Phase I

Completed Technology Project (2016 - 2016)



## Project Introduction

As NASA missions continue to extend the horizon beyond near-Earth missions, higher performance systems must evolve to address the challenges of reduced power resources, longer mission durations, higher radiation exposure, and more broadly, harsher space environments. The vision of the low-temperature and input power Deep Space Cryocooler System (DSCS) is to advance the state of the art in Cryocooler systems by developing a low-cost single stage cryocooler, designed to target low heat rejection temperatures (150K) and low cold-tip temperatures (35K), and integrate it with a set of high reliability, micro-sized Low Cost Cryocooler Electronics ( $\mu$ LCCE) customized to operate efficiently at very low power levels (10W). Additionally, the low-cost, light weight, and small size of the DSCS will enable instrumentation on miniature satellite platforms. A key objective of this effort is to develop and demonstrate cryogenic cooling technologies for science measurement capabilities with smaller, more affordable spacecraft and concurrently reducing system risk, cost, size, and development time, consistent with NASA SBIR Science Subtopic S1.09. In the Phase I effort, the  $\mu$ LCCE brassboard will improve upon the mLCCE (TRL6 in 2016) design by evaluating a handful of candidate improvements that will reduce the SWaP requirements of the electronics. Detailed circuit modeling will verify performance of key parameters, which will then inform the final schematic and layout of the  $\mu$ LCCE. The accompanying Thermo-Mechanical Unit will be designed by Lockheed Martin. The conceptual coldhead design leverages their existing TRL 6 Microcryocooler, and will introduce design improvements to target the low heat reject and cold-tip temperatures specified in this solicitation. The design approach will be confirmed with detailed thermodynamic modeling. A prototype  $\mu$ LCCE and upgraded microcryocooler will be built and integration tested in a future Phase II effort.



Deep Space Cryocooler System (DSCS), Phase I

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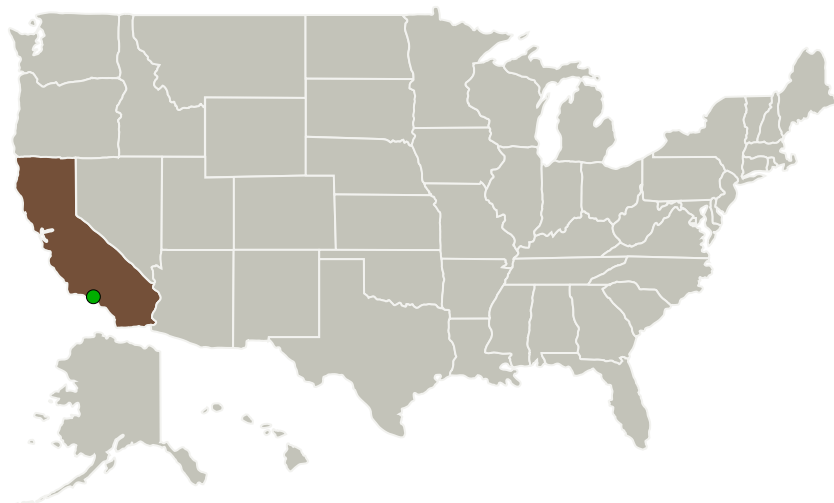
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## Deep Space Cryocooler System (DSCS), Phase I

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Iris Technology Corporation	Lead Organization	Industry	Irvine, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Primary U.S. Work Locations

California

## Project Transitions

▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140349>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Iris Technology Corporation

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

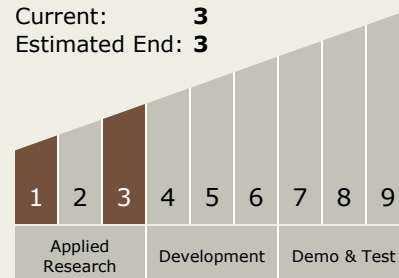
Carlos Torrez

## Principal Investigator:

Mitul Jambusaria

## Technology Maturity (TRL)

Start: **1**  
Current: **3**  
Estimated End: **3**

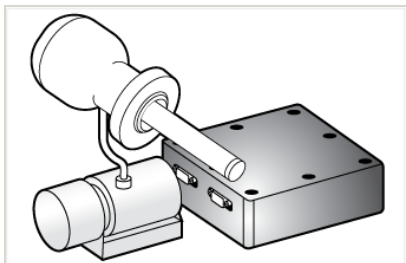


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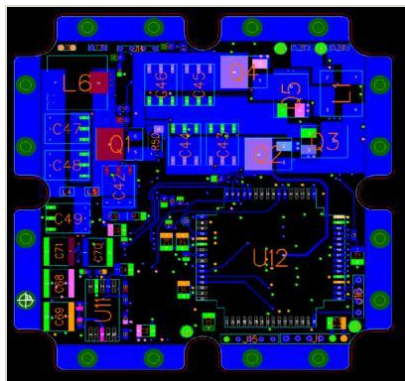
### Images



#### Briefing Chart Image

Deep Space Cryocooler System  
(DSCS), Phase I

(<https://techport.nasa.gov/image/131771>)



#### Final Summary Chart Image

Deep Space Cryocooler System  
(DSCS), Phase I Project Image  
(<https://techport.nasa.gov/image/135630>)

### Technology Areas

#### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

### Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System